



Genital system

- Anatomically, the genital system is subdivided into:

- 1- sex glands (Testis and Ovary).

- 2- duct system (male or female duct system)

- 3- external genitalia (scrotum and penis in male, vulva in female) .

- Embryologically, from the time of fertilization the sex of the embryo can be determined genetically (male XY and female XX).
- In early stage of development the sex of embryo cannot be differentiated anatomically or histologically, this stage is termed indifferent stage.
- Later on ,sex hormones induce differentiation into male or female and in the same time the structure of the other sex degenerate.

Indifferent Stage:-

- In this stage the sex of the embryo cannot be differentiated anatomically or histologically.
- This stage includes development of : -
 - gonads.
 - duct system
 - external genitalia.

A- Gonads

1. Due to enlargement of mesonephros, it bulges ventrolaterally into the coelum forming a longitudinal **urogenital ridge**.
2. This ridge subdivided longitudinally into a lateral **urinary ridge** and medial **genital ridge**.

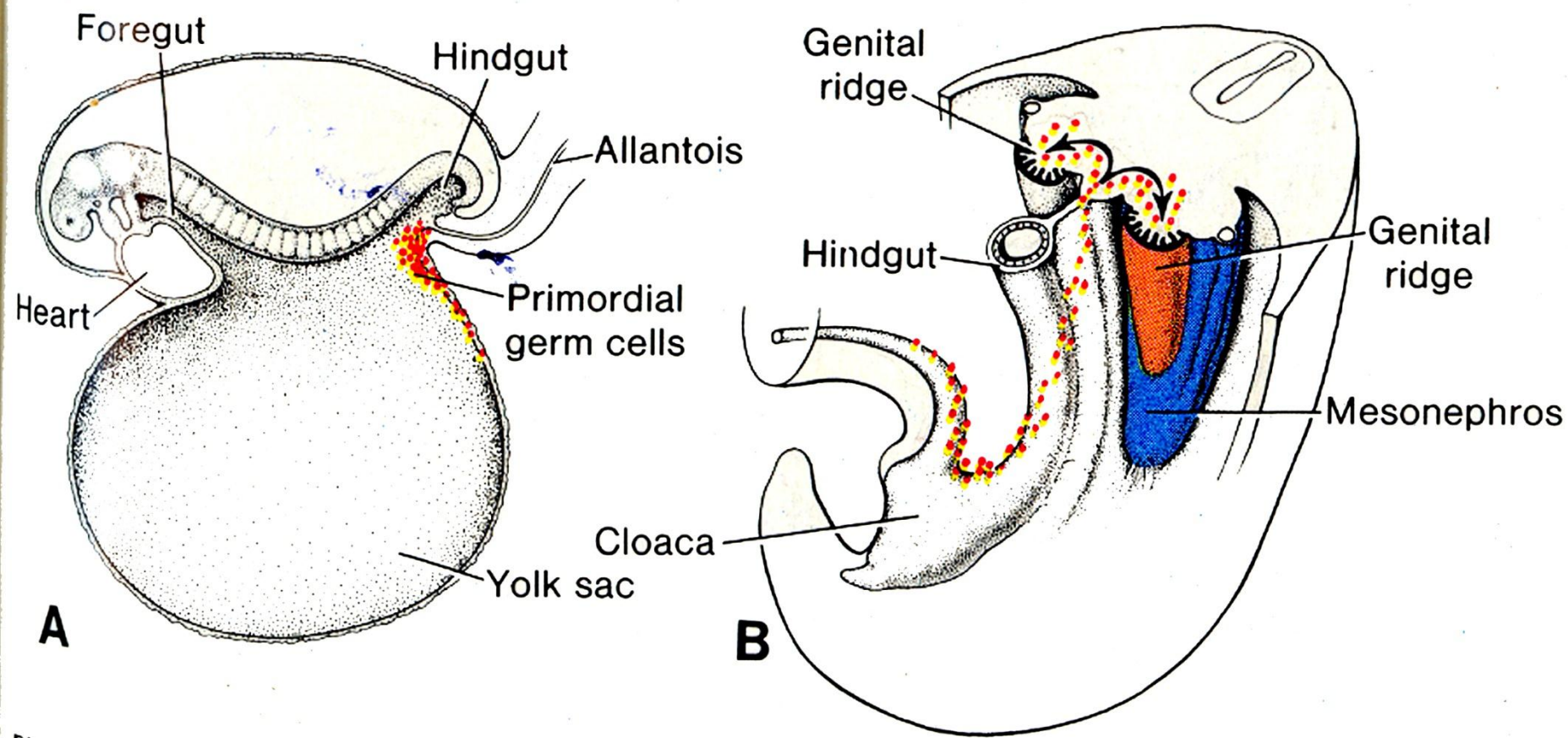


Figure 15-15. A, Schematic drawing of a three-week-old embryo showing the primordial germ cells in the wall of the yolk sac, close to the attachment of the allantois (after Witchi). B, Drawing to show the migration path of the primordial germ cells along the wall of the hindgut and the dorsal mesentery into the genital ridge.

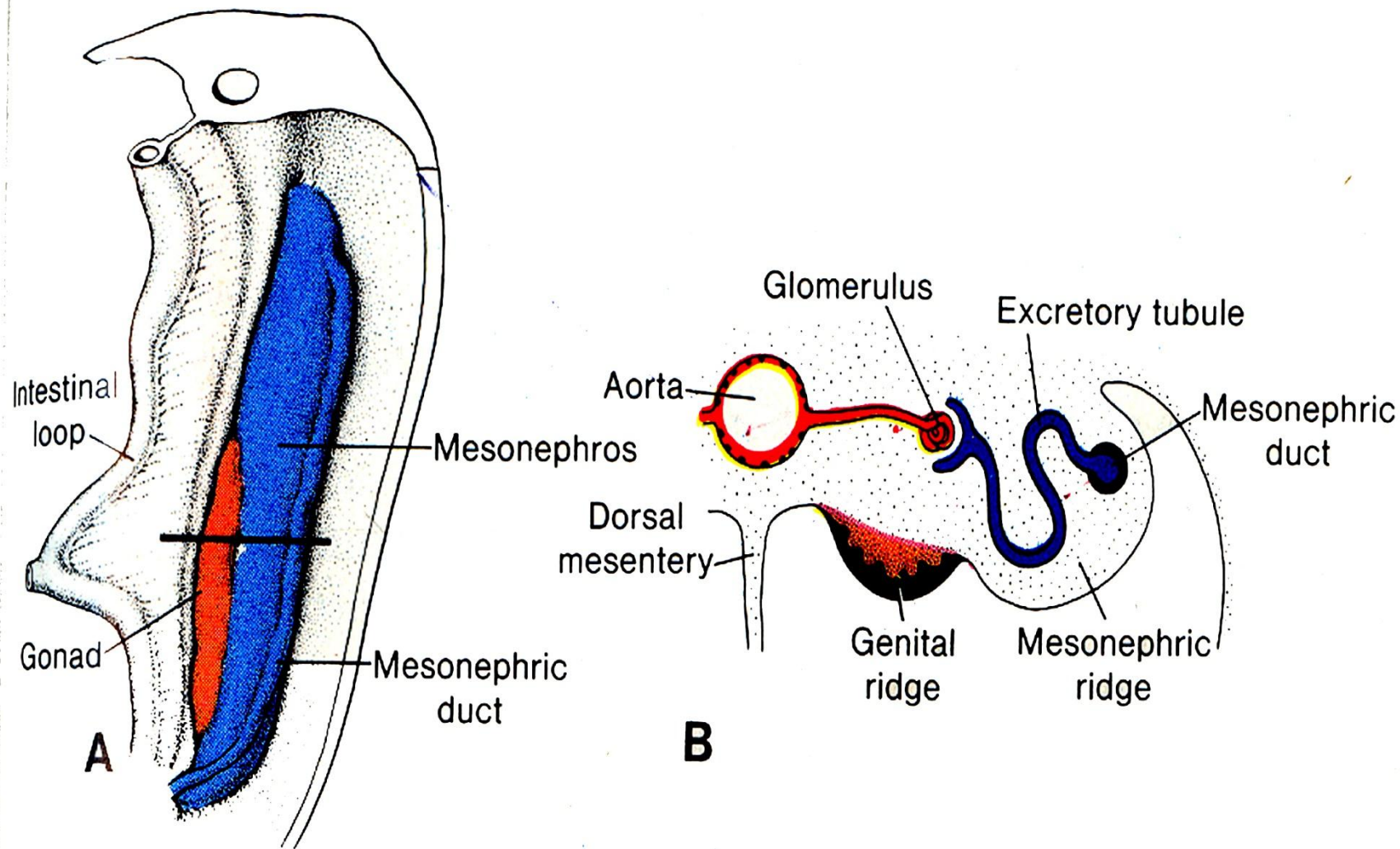


Figure 15-14. A, Drawing to show the relationship of the genital ridge and the mesonephros. Note the location of the mesonephric duct. B, Transverse section through the mesonephros and genital ridge at a level indicated in A.

2. The genital (gonadal) ridge or gonad results from proliferation of celomatic epithelium.
3. This celomatic epithelium forms **sex cord** which project in the underlying mesenchyme .

4. The primordial germ cells which are located between the endodermal cells of the yolk sac, migrate through the mesentery of the hind gut to be located in the sex cord of the gonads.
5. Therefore the gonad has three types of cells:
 - Primordial germ cells.
 - celomatic cells
 - mesenchymal cells.

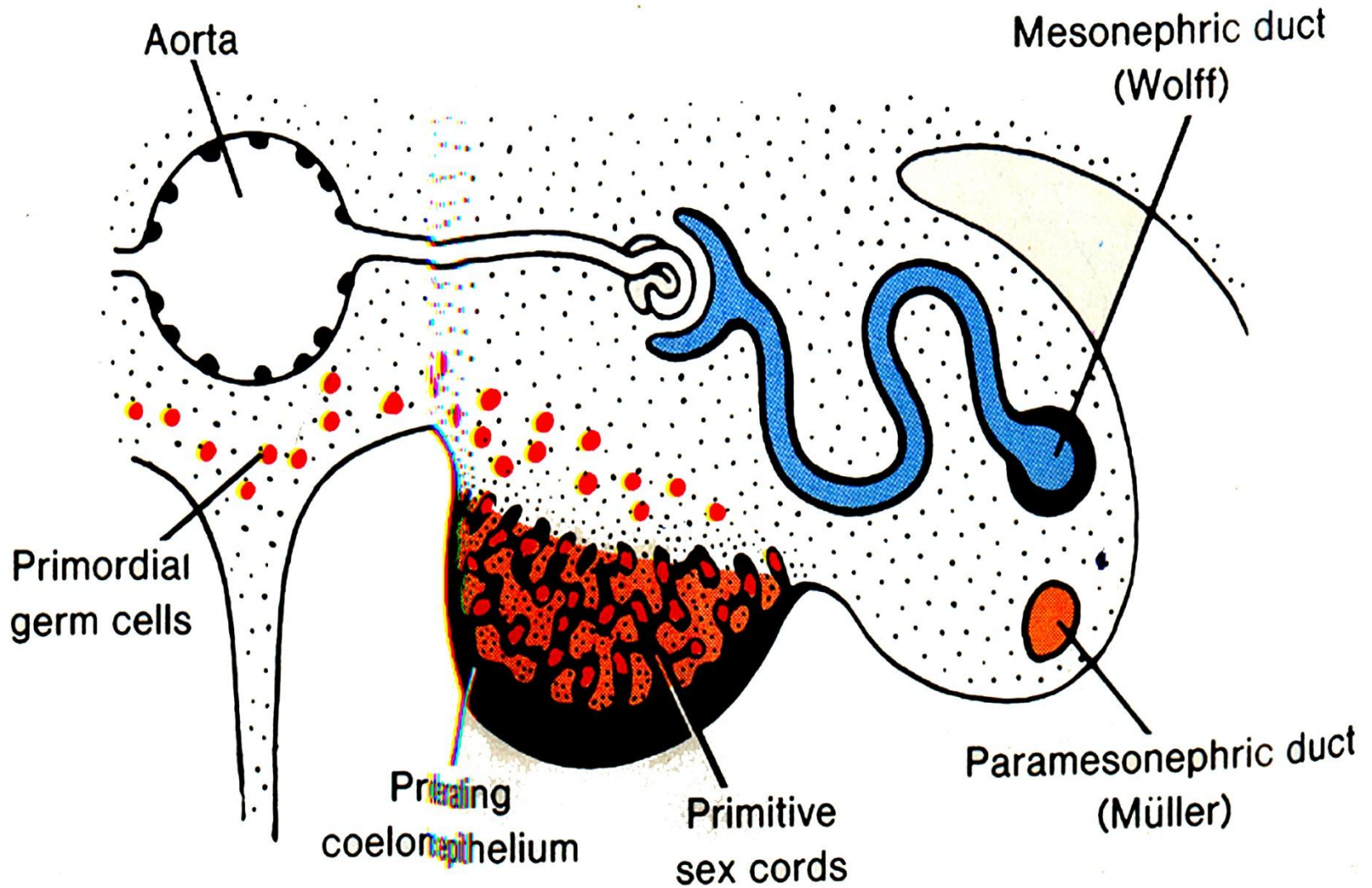


Figure 15-16. Schematic cross section through the lumbar region of a six-week embryo, showing the different gonad with the primitive sex cords. Some of the primordial germ cells are surrounded by cells of the primitive sex cords.

B- Duct system

- Both male and female embryos have initially two pairs of genital ducts: Mesonephric and Paramesonephric.

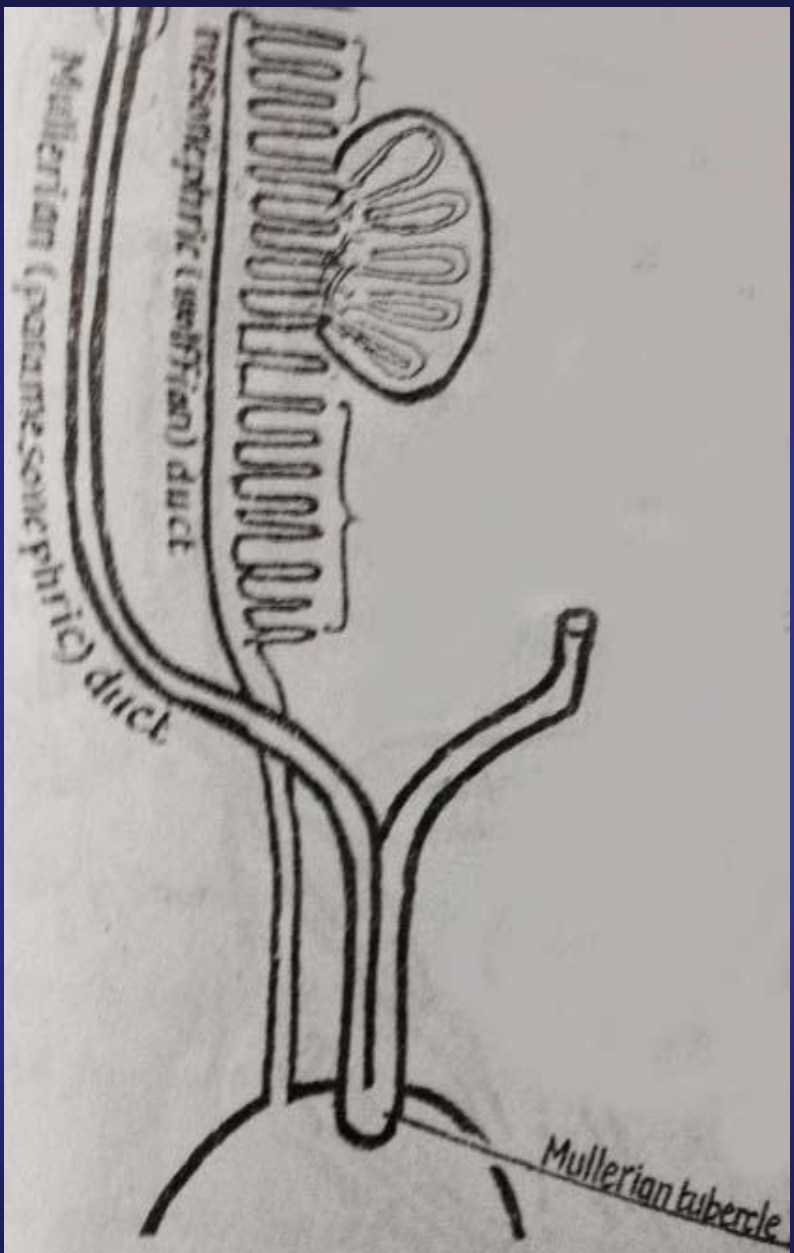
1. Mesonephric (Wolffian) duct:

- The Mesonephric duct and tubules remain after degeneration of mesonephros forming the male duct system.

2- Paramesonephric (Mullerian) duct

- Arises as longitudinal invagination of the dorsolateral aspect of urogenital ridge lateral to the mesonephric duct.
- Cranially the duct opens in the celomatic cavity, caudally it runs at first lateral to the mesonephric duct, then crosses it ventrally to grow caudomedially.

- In the midline it comes in contact with that of the opposite side forming the **fused part** which projects in the urogenital sinus forming **paramesonephric (mullerian) tubercle**.



C- External genitalia

- **Genital tubercle** appears in the ventral aspect of the embryo between the umbilicus and tail .
- This tubercle extends cranially and gives **phallus**.
- Its expanded cranial end called **glans of phallus**.

- Caudally, **urogenital groove** appears which is flanked on either side by **urogenital fold** and its floor called **urogenital membrane**.
- On either side of urogenital groove there is a **genital swelling**.

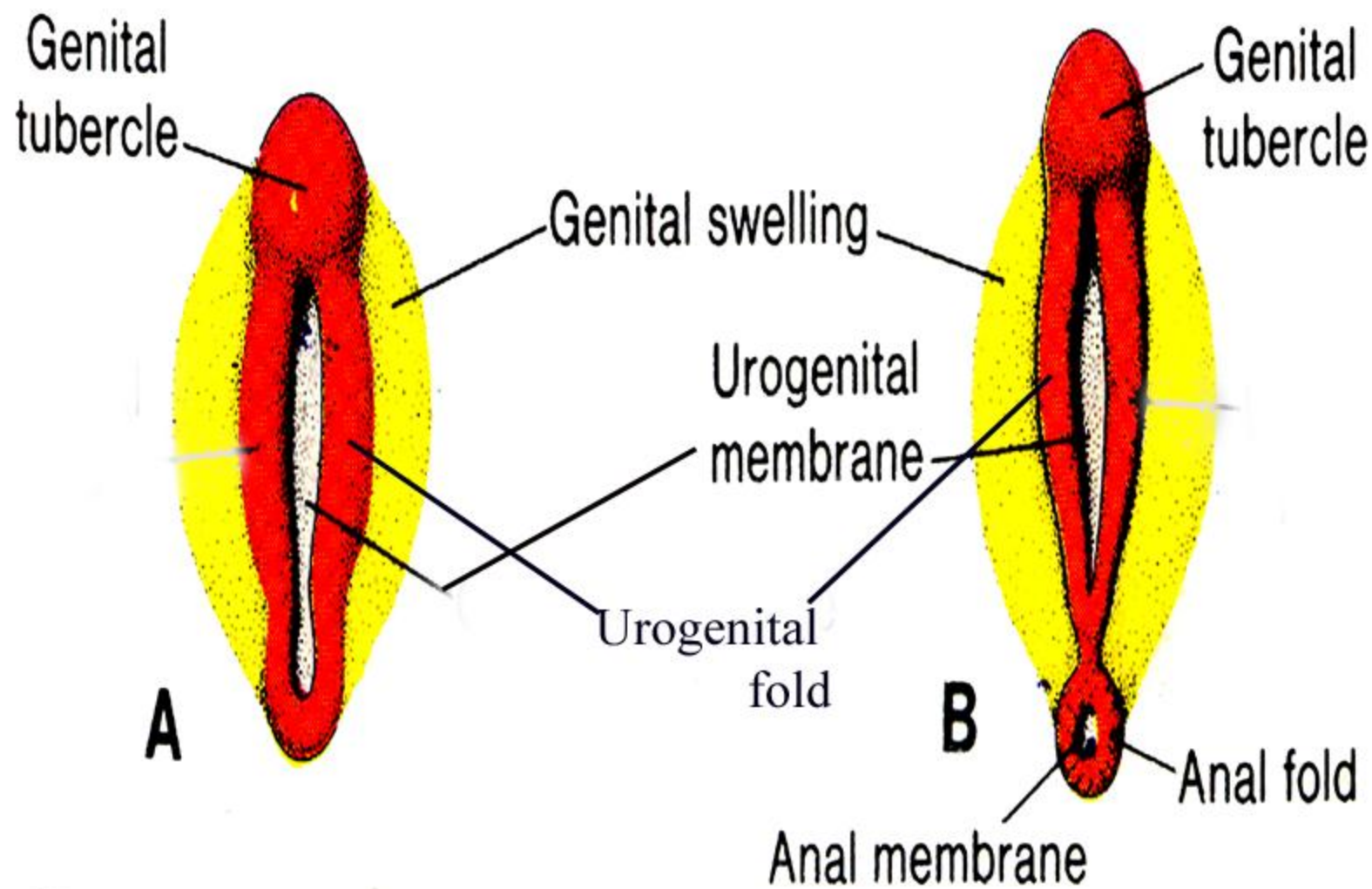


Figure 15-26. The indifferent stage of the external genitalia. A, At approximately four weeks; B, at approximately six weeks.

Genital system

Differentiation of testis :-

- If the embryo is genetically male, the primordial germ cells carry XY chromosome. Under influence of Y chromosome the gonad is differentiated into testis.

- The gonad is constricted from urinary ridge forming **mesorchium**.
- The cells arranged in **testicular cords**.
- Each cord consists of two types of cells (**celomatic and primordial germ**).
- Between these cords, **mesenchymal cells** are located.
- Condensation of some mesenchymal cells between testicular cords forming **tunica albuginea** and centrally anastomose with each other forming **mediastinum**.

- Appearance of testicular cords and tunica albuginea indicates that the gonad will differentiate into testis.
- The testicular cords extend toward the mesorchium where they anastomosis with each other forming **rete testis**.
- Each testicular cord consists of **peripheral part** which becomes contorted and **central part** which becomes straight.

➤ some mesenchymal cells between testicular cords differentiate into **Ledig cells** which secrete testosterone hormone which is responsible for differentiation of male duct system and external genitalia.

- **Before birth**, canalization of rete testis occurs, but canalization of testicular cords takes place at **puberty**.
- Consequently, the testicular cords become the seminiferous tubules.
- The contorted part and straight part of testicular cord become **tubuli contorti** and **tubuli recti** respectively.

➤ The celomatic and primordial germ cells which form testicular cord lined the seminephrous tubules.

➤ **Differentiation of the cells:**

- ✓ primordial germ cells → **spermatogonia**
- ✓ celomatic cells → **sertoli cells**
- ✓ mesenchymal cells between testicular cords → **ledig cells** and **supporting tissue**.

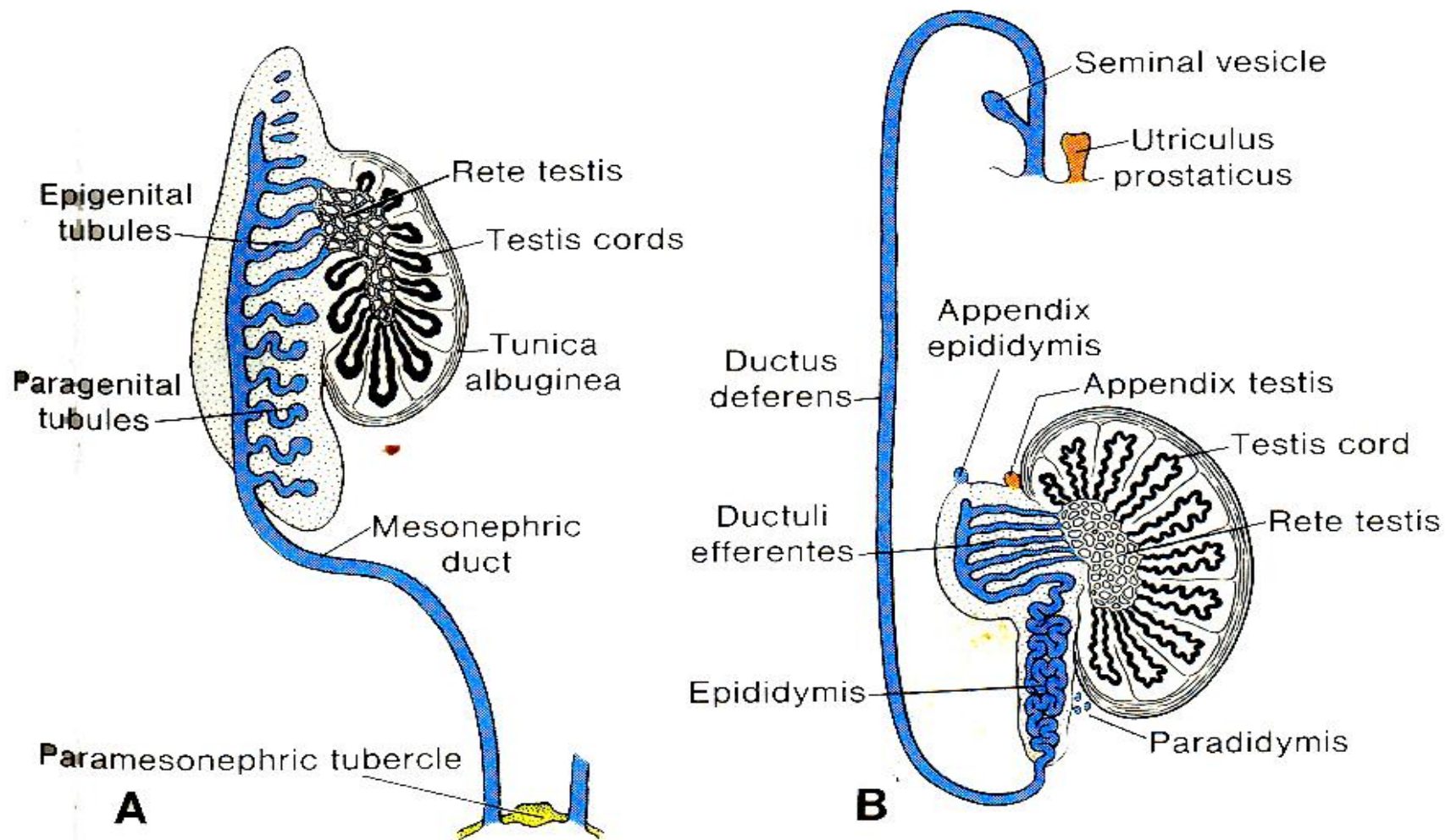


Figure 15-20. A, Diagram of the genital ducts in the male in the fourth month of development. The paramesonephric duct has degenerated except for the appendix testis and the utriculus prostaticus. B, The genital duct after descent of the testis. Note the horseshoe-shaped testis cords, the rete testis, and the ductuli efferentes entering the ductus deferens. The paradidymis is formed by the remnants of the paragenital mesonephric tubules.

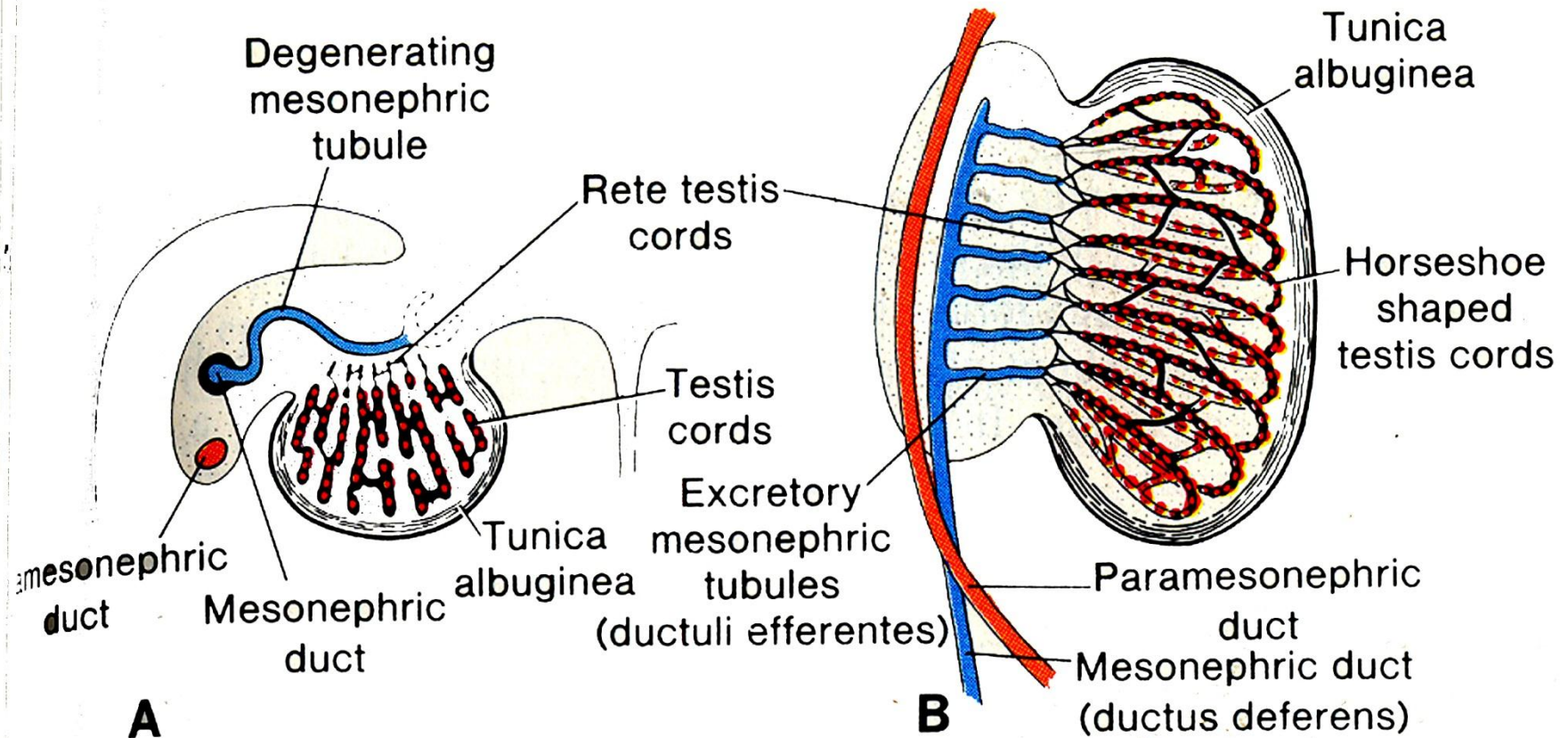


Figure 15-17. A, Transverse section through the testis in the eighth week of development. Note the tunica albuginea, the testis cords, the rete testis, and the primordial germ cells. The glomerulus and Bowman's capsule of the mesonephric excretory tubule are in regression. B, Schematic representation of the testis and the genital ducts in the fourth month of development. The horseshoe-shaped testis cords are continuous with the rete testis cords. Note the ductuli efferentes (excretory mesonephric tubules) which enter the mesonephric duct.

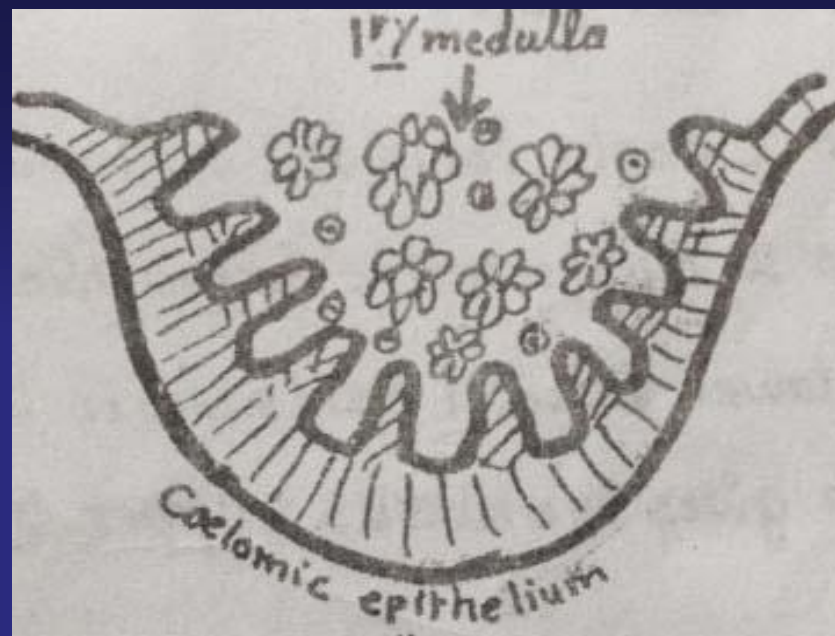
Differentiation of ovary:-

- If the embryo is genetically female, the primordial germ cells carry XX sex chromosome complex. Therefore the gonad differentiates into ovary.
- The gonad is constricted from the urinary ridge forming **mesovarium**.

- The cells of the gonad which are primordial germ cells, coelomic and mesenchymal cells are **proliferated and arranged** in 3 regions:-
 - **Externally** → The cells become densely arranged and form the **primary cortex**.
 - **Centrally** → The cells become loosely arranged to form the **primary medulla**.
 - **At the mesovarian** → the cells arranged to form **ovarian reta**.

- The ovary enlarges due to proliferation of the cells on the surface of the primary cortex forming **secondary cortex (paranchymatous zone)**.
- The cells of primary cortex and medulla are **regressed**.
- Then invasion of blood vessels, smooth muscle fibers, nerves and connective tissue through mesovarium into ovarian rete, primary medulla and primary cortex therefore these **areas** become the **secondary (permenant) medulla (vascular zone)**.

- Connective tissue from the region of ovarian rete forming **septules**
- These septules reach the surface and connected with each other forming thin **tunica albuginea**.
- Each follicle contains centrally located primordial germ which become the oogonia and surrounded by coelomic cells which become the follicular cells . This follicle termed the **primary follicle**.
- The mesenchymal cells between the follicles form the supporting tissue.



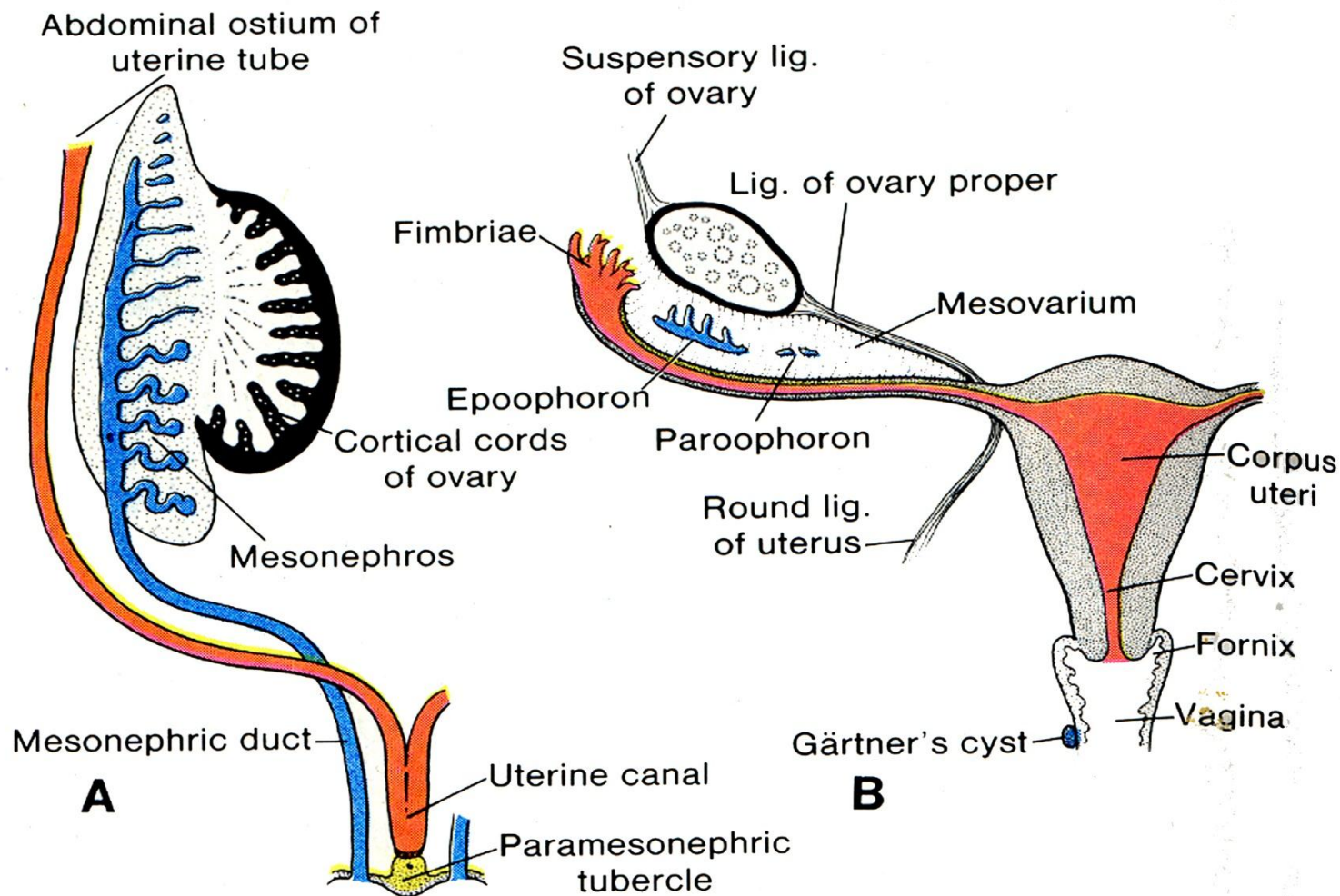


Figure 15-21. A, Schematic drawing of the genital ducts in the female at the end of the second month of development. Note the paramesonephric or Müllerian tubercle and the formation of the uterine canal. B, The genital ducts after descent of the ovary. The only parts remaining of the mesonephric system are the epoophoron, paroophoron, and Gärtner's cyst. Note the suspensory ligament of the ovary, the ligament of the ovary proper, and the round ligament of the uterus.

Descent of the gonad

- The original position of the testis and ovary **changes** during development.
- At first they are slender structures lying in the **roof of body** cavity caudal to the diaphragm.

Internal descent :-

- A faster elongation of the trunk **cranially** in contrast to the **slower growth** of the gonad produces a relative shift of later in a **caudal direction (internal descent)** until the gonads lie at the boundary between the abdomen and pelvis.
- The internal descent concerns the testis and ovary.

External descent of testis:-

- . External descent means testis descends into the **scrotum** .
- It concerns the **testis only**.
- In addition to its early caudal migration (internal descent). The testis later leaves the abdominal cavity and descends into the **scrotum**.

1. At first the testis which is located in the roof of the abdominal cavity is connected with the scrotum by **gubernaculum testis**.
2. The peritoneum evaginates into the scrotum forming **vaginal process**.
3. Vaginal process remains connected with the peritoneal cavity.
4. As a result of **shortening** of gubernaculum , the testis descends gradually into the scrotum **caudal to** the vaginal process.

5. The testis invaginates into the vaginal process to form **visceral layer** of vaginal tunic covering the testis and **parietal layer** of vaginal tunic lining the scrotum.
6. The vaginal cavity lies between the two layers of **vaginal tunic**.

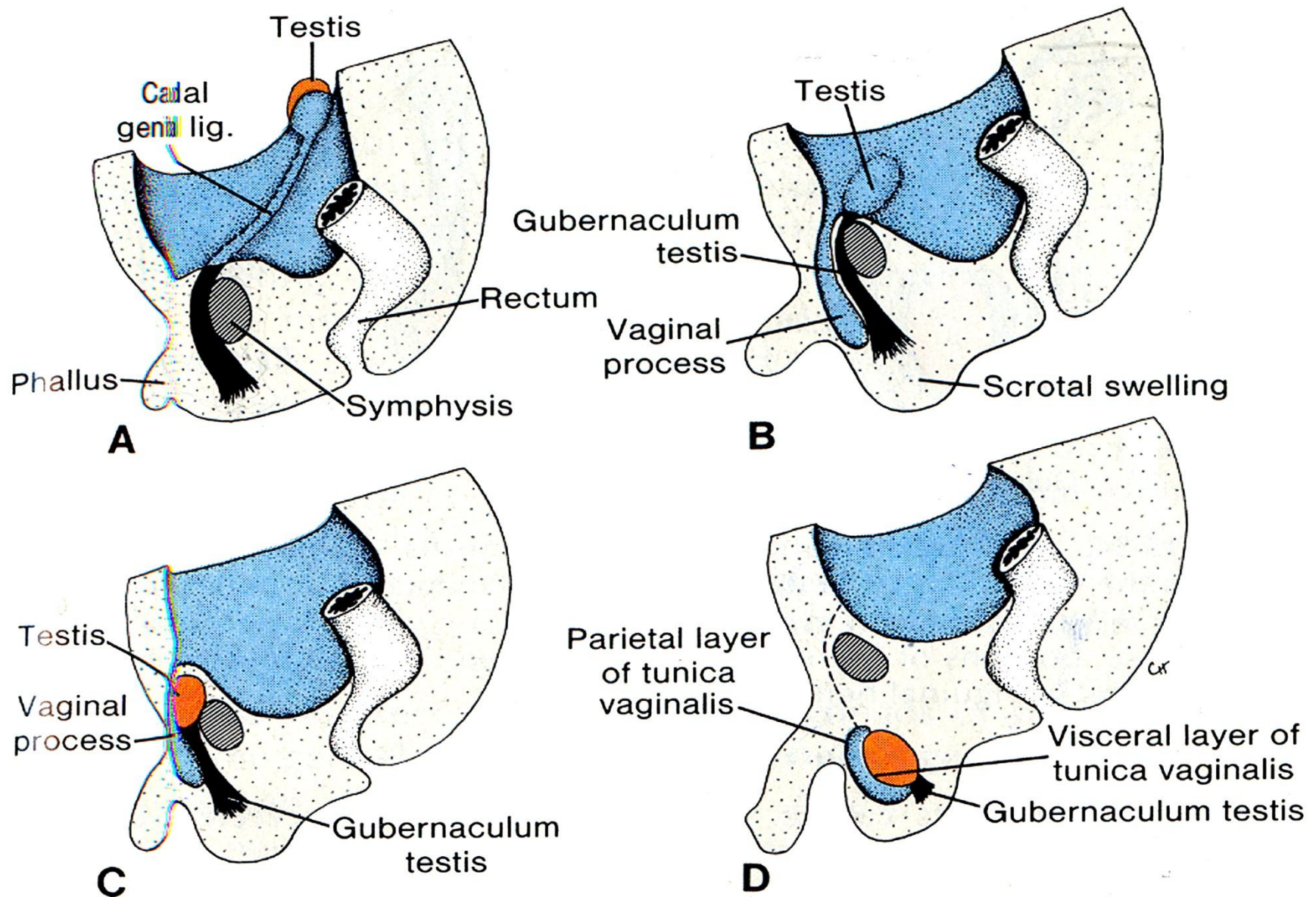


Figure 15-31 Schematic representation of the descent of the testis. *A*, During the second month; *B*, middle of the third month; note that the coelomic cavity evaginates into the scrotal swelling, where it forms the vaginal process (tunica vaginalis); *C* seventh month; *D*, shortly after birth.

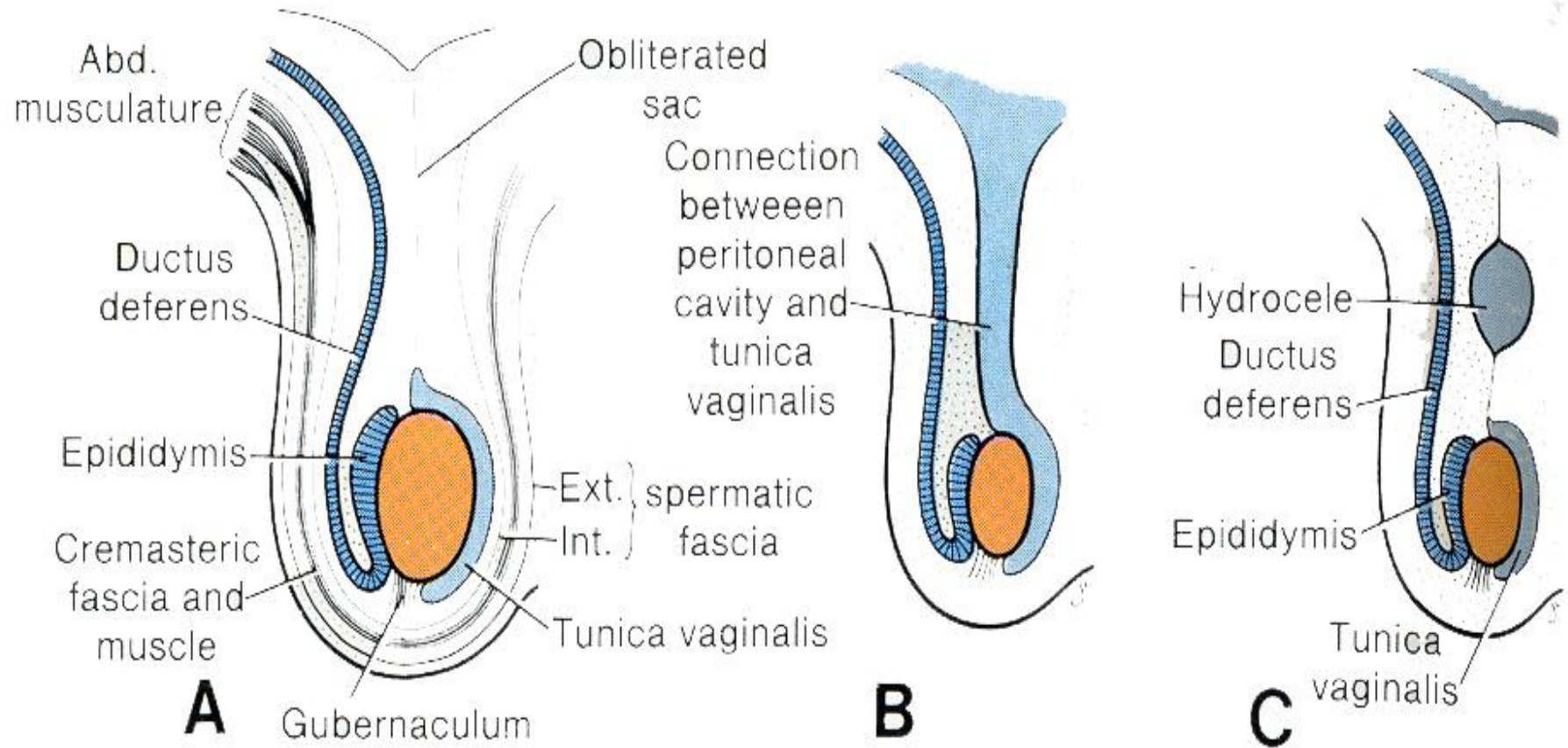


Figure 15-34. *A*, Diagrammatic drawing of the testis, epididymis, ductus deferens, and the various layers of the abdominal wall which surround the testis in the scrotum. *B*, Vaginal process in open communication with the peritoneal cavity. In such a case, portions of the intestinal loops often descend toward the scrotum, thus causing an inguinal hernia. *C*, Hydrocele.

Differentiation of duct System

A- Mesonephric duct and tubules:

I- In Male:-

- The mesonephric duct and tubules form the male duct system.
- The mesonephric tubules are connected with the rete testis forming efferent ductules of testis “Head of epididymis”.

- Cranial end of mesonephric duct becomes convoluted forming **epididymal duct** (body and tail of epididymis).
- Caudal part of mesonephric duct straighten forming **ductus deference**.
- Lower part of the duct is thickened forming **ampulla ductus deference**.
- Distal to **ampulla d.d.** , invagination of a bud forming **vesicular gland**.

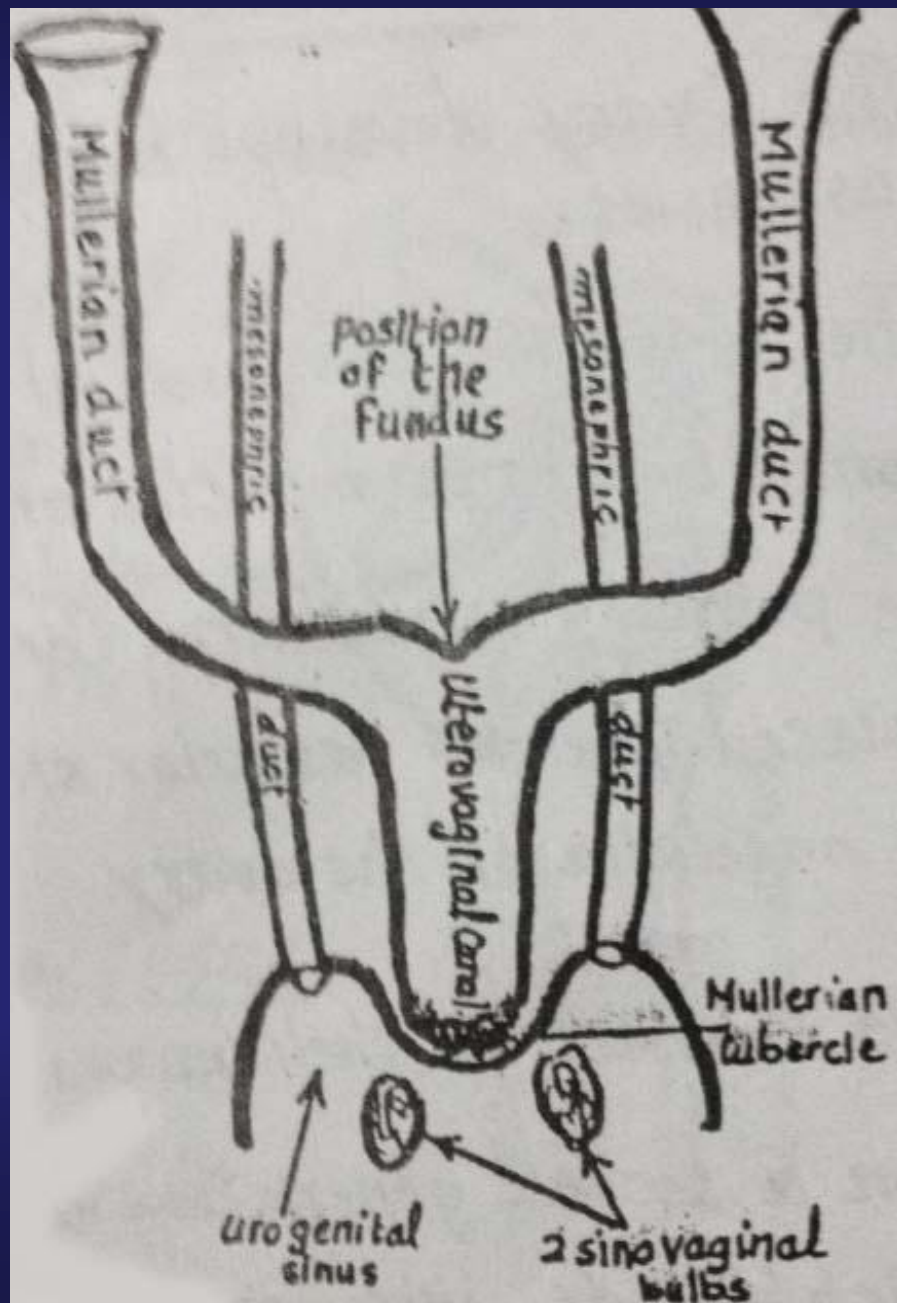
2. In Female:-

- The mesonephric duct **disappears entirely** except a small caudal portion which may be found in the floor of the **uterus or vagina.**
- Later on this portion may form a cyst known as **Gartenar's cyst.**

B- Paramesonephric (Mullerian) duct:

1-In Female:-

- It forms the **female duct system**.
- The Proximal longitudinal part becomes coiled to form **uterine tube**.
- The middle oblique part enlarged to form **uterine horn**.
- The fused part forms **body, cervix and vagina proper**.
- The Mullerian tubercle forms **hymen**.



2. In Male:-

- Paramesonephric duct **disappears entirely** and its remnant are:
- Its tip forms **appendix testis**.
- Its fused middle part gives off **uterine musculinaus**.
- Mullerian tubercle gives **colliculus seminalis**.

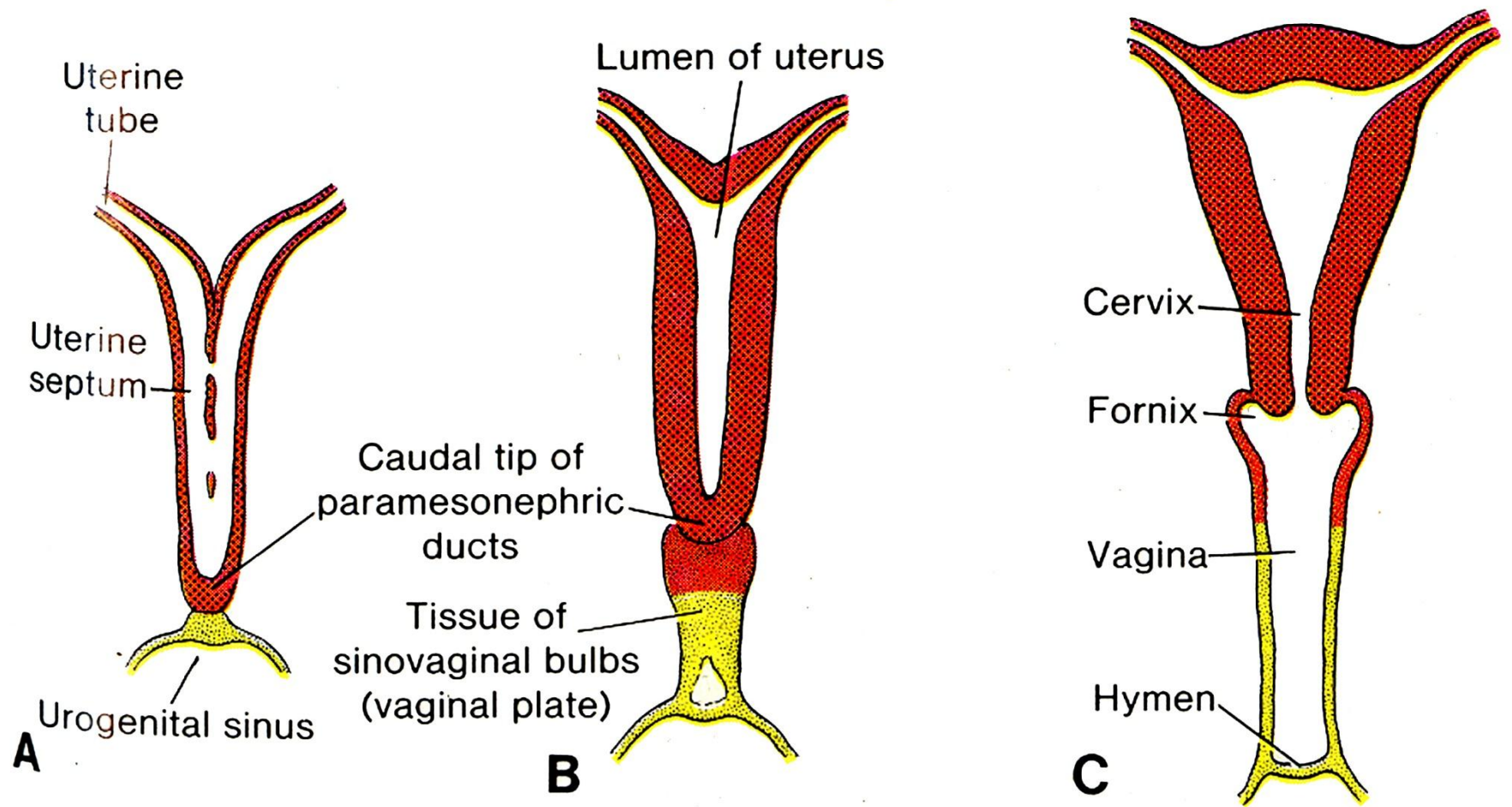


Figure 15-23. Schematic drawing showing the formation of the uterus and vagina. *A*, At nine weeks. Note the disappearance of the uterine septum. *B*, At the end of the third month. Note the tissue of the sinovaginal bulbs. *C*, Newborn. The upper third of the vagina and the fornices are formed by vacuolization of the paramesonephric tissue and the lower two-thirds by vacuolization of the sinovaginal bulbs.

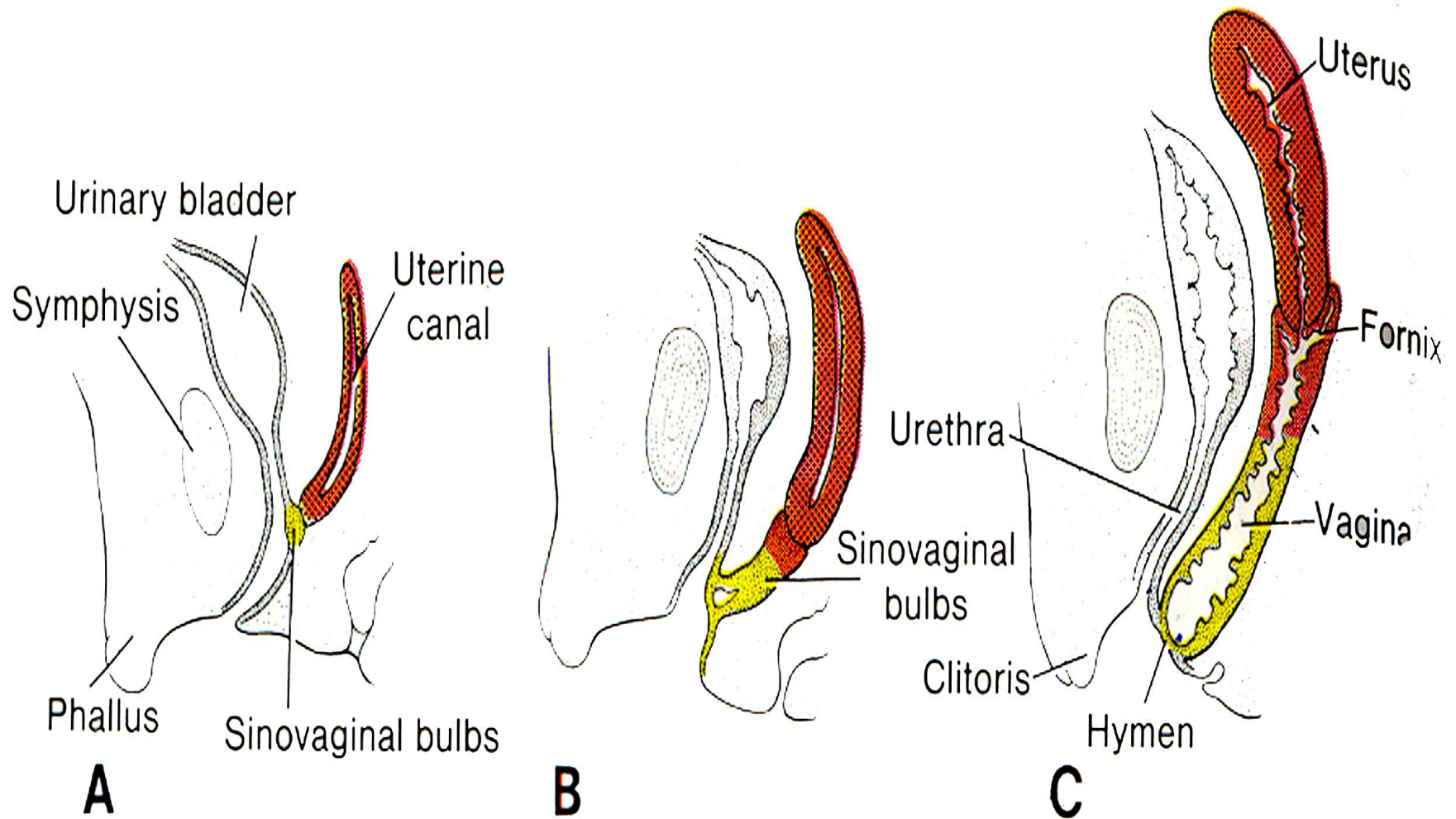


Figure 15-24. Schematic sagittal sections showing the formation of the uterus and vagina at various stages of development.

Differentiation of external genitalia

- In male:
- Genital tubercle (phallus): penis
- Urogenital fold: penile urethra
- Genital swelling: scrotum
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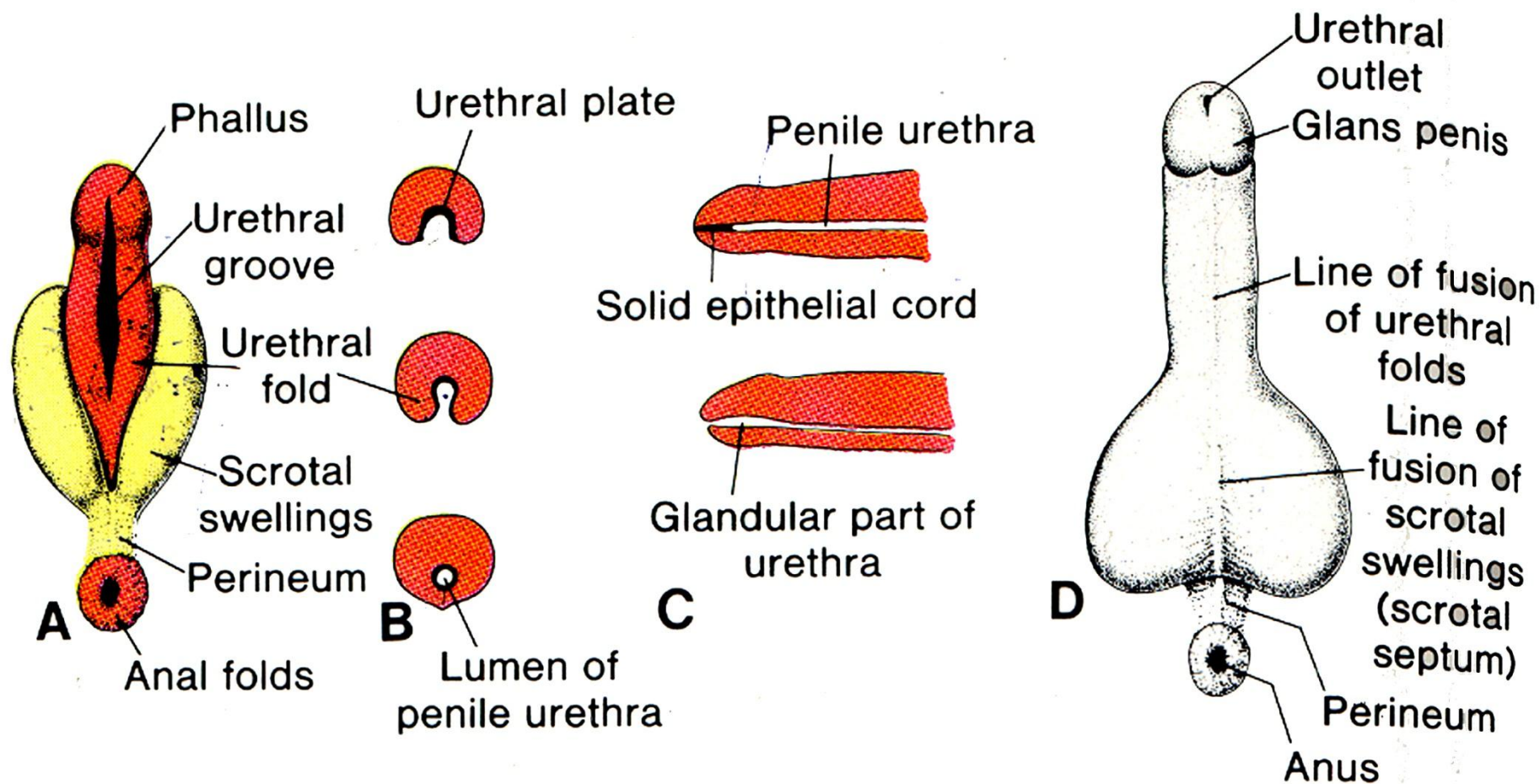


Figure 15-27. A, Development of the external genitalia in the male at 10 weeks. Note the deep urethral groove flanked by the urethral folds. B, Transverse sections through phallus during the formation of the penile urethra. The urogenital groove is bridged over by the two urethral folds. C, Development of the glandular portion of the penile urethra. D, In the newborn.

Differentiation of external genitalia

- In female:
 - Genital tubercle (phallus): clitoris
 - Urogenital fold: labia minor
 - Genital swelling: labia major
- } In animals: vulva

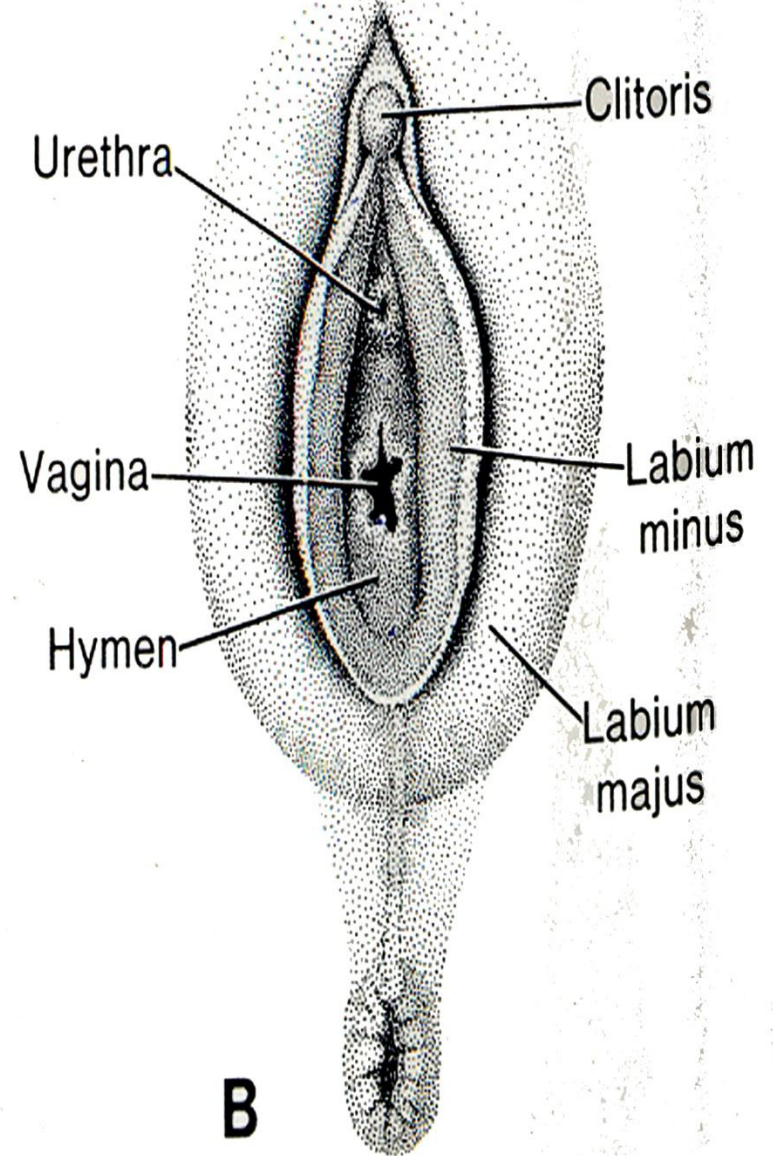
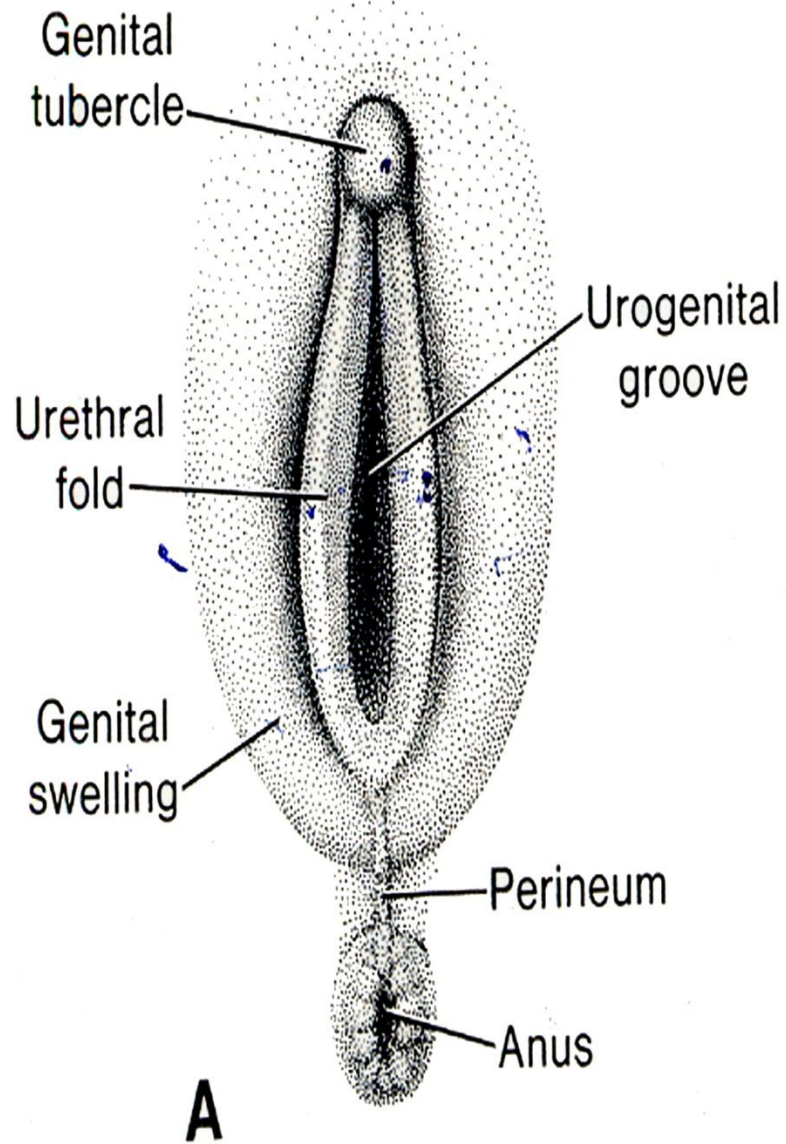


Figure 15-29. Development of the external genitalia in the female at five months⁵ (A), and in the newborn (B).

Anomalies of genital system

I-Male genital system

A-The testis:-

1. Congenital inguinal hernia:

- Connection between celomatic cavity and vaginal process normally closes in first year after birth.
- If this passageway remains open , intestinal loop may descend into the scrotum causing congenital inguinal hernia.

2. Hydrocoele:

- Sometimes the obliteration of the passage between coelomic cavity and vaginal process is irregular leaving a cyst along its course.
- This cyst may secrete excess fluid resulting in the formation of hydrocoele.

3. Cryptorchidism or undescended testis:

- At about the time of birth testis arrive in scrotum.
- One or both testes may remain in pelvic cavity or in inguinal canal thus testis not descend into scrotum. This condition is known as cryptorchidism
- The testis is unable to produce mature spermatozoa because of high temperature in the abdominal cavity

B- The penis:-

1- Hypospadias:

-when fusion of **urogenital folds** is incomplete, abnormal openings of the urethra is found on ventral aspect of penis.

2- Epispadias:

-Abnormal openings of urethra found on dorsal aspect of penis.

3. Agenesis of penis:

- This abnormality results from **the failure** of **genital tubercle** to develop.
- The urethra usually opens into perineum near the anus.
- The scrotum is normal and testis descends into it.

I-Female genital system

Uterovaginal malformation:

- Various types uterine duplication and vaginal malformation result from improper fusion of the paramesonephric ducts.

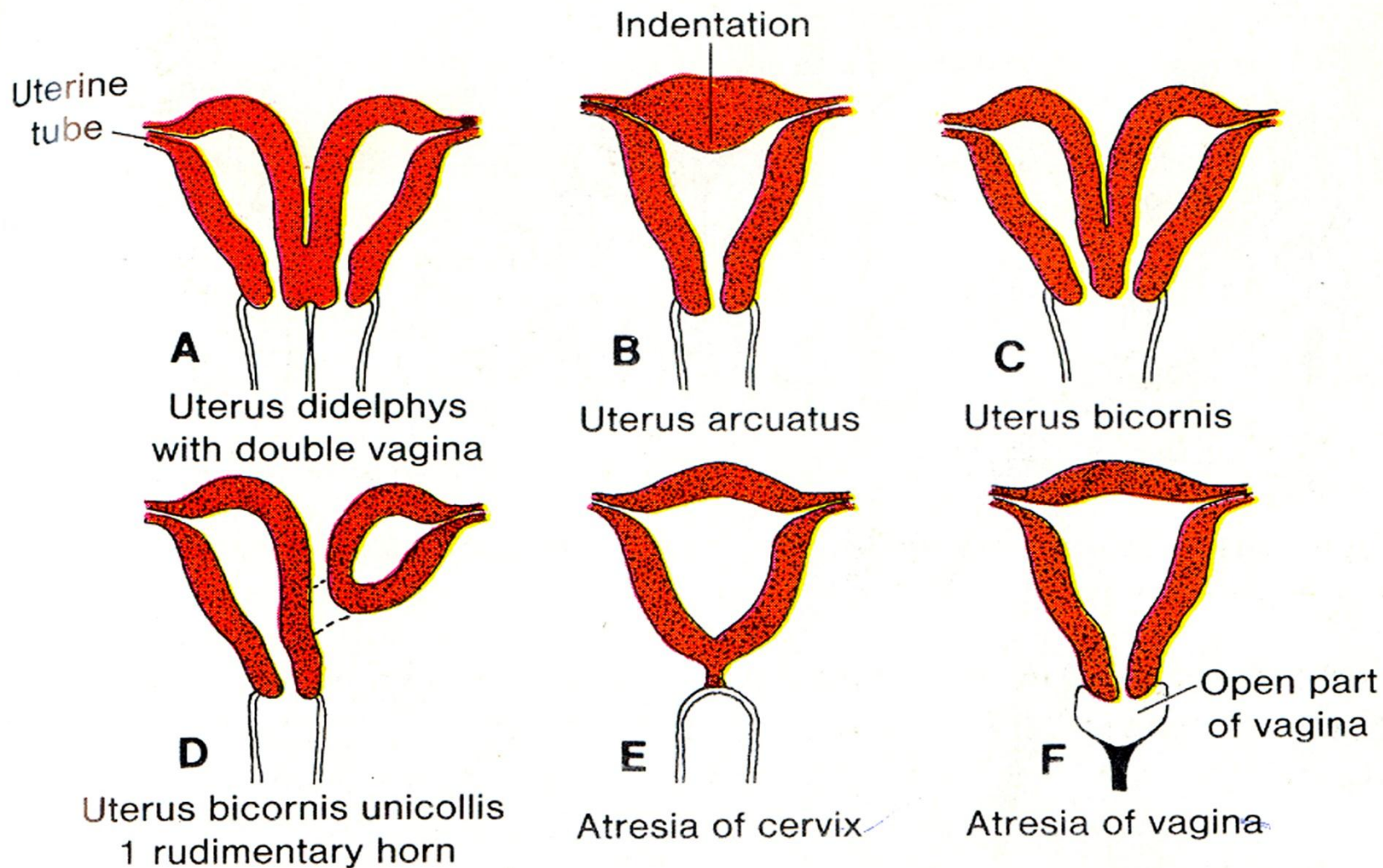


Figure 15-25. Schematic representation of the main abnormalities of the uterus and vagina, caused by persistence of the uterine septum or obliteration of the lumen of the uterine canal.